What Works Clearinghouse

INSTITUTE OF EDUCATION SCIENCES

Early Childhood Education Revised April 30, 2007

Sound Foundations

Program description

Sound Foundations, a literacy curriculum designed to teach phonological awareness to preliterate children, focuses exclusively on phoneme identity (that is, different words can start and end with the same sound). It works from the principle that phonemic awareness is necessary but not sufficient to reading, which depends on the alphabetic principle (that is, the association of sounds with letters and using those sounds to form words). The curriculum is self-contained and can be used by teachers, parents, or teaching assistants.

Research

One study of *Sound Foundations* met the What Works Clearinghouse (WWC) evidence standards.[1] This study included 26 preschool children and examined intervention effects on children's phonological processing and early reading/writing. This report focuses on immediate posttest findings to determine the effectiveness of the intervention; however, follow-up findings provided by the study authors are included in the technical appendices.[2]

The WWC considers the extent of evidence for *Sound Foundations* to be small for phonological processing and early reading/writing. No studies that met WWC evidence standards with or without reservations addressed oral language, print knowledge, cognition, or math.

Effectiveness

Sound Foundations was found to have potentially positive effects on phonological processing and early reading/writing.

	Oral language	*Print knowledge*	*Phonological processing*	*Early reading/ writing*	*Cognition*	*Math*
Rating of effectiveness	na	na	Potentially positive effects	Potentially positive effects	na	na
Improvement Index[3]	na	na	na	na	na	na

na = not applicable

1. To be eligible for the WWC's review, the Early Childhood Education (ECE) interventions had to be implemented in English in center-based settings with children ages 3 to 5 or in preschool. One additional study is not included in the overall effectiveness rating because the intervention included a combination of *Sound Foundations* and *Dialogic Reading,* which does not allow the effects of *Sound Foundations* alone to be determined. See the section titled "Findings for *Sound Foundations plus Dialogic Reading*" and Appendices A4.1–A4.4 for findings from this and a related document.
2. The evidence presented in this report is based on available research. Findings and conclusions may change as new research becomes available. There are three follow-up manuscripts to Byrne and Fielding-Barnsley (1991). Because these report on the same sample, the four manuscripts are treated as one study.
3. Student-level improvement indices could not be computed for the outcome domains studied, phonological processing and early reading/writing.

Absence of conflict of interest

The WWC ECE topic team works with two Principal Investigators (PIs): Dr. Ellen Eliason Kisker and Dr. Christopher Lonigan. The studies on *Sound Foundations* reviewed by the ECE team included two studies on which Dr. Grover Whitehurst, director of the Institute for Education Sciences, was either the primary or a secondary author. Dr. Whitehurst's financial interests are not affected by the success or failure of *Sound Foundations,* and he does not receive any royalties or other monetary return from the use of *Sound Foundations.* In all instances where Dr. Whitehurst was a study author, he was not involved in the decision to include the study in the review, and he was not involved in the coding, reconciliation, or discussion of the included study. Drs. Kisker and Lonigan led all review activities related to those studies. The decision to review *Sound Foundations* was made by the PIs in collaboration with the rest of the ECE team following prioritization of interventions based on the results from the literature review. This report on *Sound Foundations* was reviewed by a group of independent reviewers, including members of the WWC Technical Review Team and external peer reviewers.

Additional program information

Developer and contact

Developed by Brian Byrne and Ruth Fielding-Barnsley. Correspondence concerning *Sound Foundations* should be addressed to Brian Byrne, Department of Psychology, University of New England, Armidale, New South Wales 2351, Australia. E-mail: bbyrne@une.edu.au.[4]

Scope of use

Sound Foundations was developed in the late 1980s. The first published study appeared in 1991 (Byrne & Fielding-Barnsley, 1991). Information is not available on the number or demographics of children or centers using this intervention.

Teaching

In center-based settings, teachers can use *Sound Foundations* with individual children or in small groups.

Sound Foundations emphasizes nine phonemes: seven consonants (/s/, /ʃ/ (as in ship), /l/, /m/, /p/, /t/, /g/) and two vowels (/ae/ and /e/). The first sound of each of the seven consonants is represented on one poster by a series of pictures that start with the same sound (e.g., sea, sailor, and sand) and, on another poster, the last sound of each of the seven consonants is represented by a series of pictures that end with the same sound (e.g., bus, octopus, and hippopotamus). The two vowels are also represented on a poster by pictures that focus exclusively on beginning sounds. Worksheets containing outlines of objects and characters representing the nine key phonemes, as well as the other letters of the alphabet, are also provided. Additional worksheets are available to focus on the end sounds of the nine key phonemes. *Sound Foundations* also employs two card games—dominoes and "Snap"—to emphasize four sounds (/s/, /p/, /t/, and /l/). The domino cards depict two objects on either end of the card, while "Snap" uses cards with one item depicted on each card (Byrne & Fielding-Barnsley, 1991).

Cost

Published *Sound Foundations* procedures are freely available to the public. Information is not available about the costs of teacher training and implementation of *Sound Foundations.*

Research

Four studies reviewed by the WWC investigated the effects of *Sound Foundations* in center-based settings. One study (Byrne & Fielding-Barnsley, 1991) was a randomized controlled trial that met WWC evidence standards. One additional study met the WWC evidence standards (Whitehurst, Epstein, Angell, Payne, Crone, & Fischel, 1994[5]) and is included in this report; however, Whitehurst et al. (1994) examined a combination of *Sound Foundations* and *Dialogic Reading,* which does not allow the effects

4. For more information on *Sound Foundations,* refer to Byrne, B., and Fielding-Barnsley, R. (1991). *Sound foundations: An introduction to prereading skills.* Sydney, Australia: Leyden Educational Publishers.

Research *(continued)*

of *Sound Foundations* alone to be determined. Therefore, this study is discussed separately, and the findings are not included in the intervention ratings. The remaining two studies did not meet WWC evidence screens.

Byrne and Fielding-Barnsley (1991) included 126 four- to five-year-old children from four preschools in Australia. Byrne and Fielding-Barnsley compared *Sound Foundations* to a comparison group trained on the identification of semantic (i.e., word meaning) categories.[6] This report focuses on the comparison of phonological processing outcomes and early reading/writing outcomes between the *Sound Foundations* group and the comparison group.[7]

Extent of evidence

The WWC categorizes the extent of evidence in each domain as small or moderate to large (see the What Works Clearinghouse Extent of Evidence Categorization Scheme). The extent of evidence takes into account the number of studies and the total sample size across the studies that met WWC evidence standards with or without reservations.[8]

The WWC considers the extent of evidence for *Sound Foundations* to be small for phonological processing and early reading/writing. No studies that met WWC evidence standards with or without reservations addressed oral language, print knowledge, cognition, or math.

Effectiveness

Findings

The WWC review of interventions for early childhood education addresses children's outcomes in six domains: oral language, print knowledge, phonological processing, early reading/writing, cognition, and math.[9]

Phonological processing. Byrne and Fielding-Barnsley (1991) analyzed findings for four measures in this outcome domain,[10] all of which favored the *Sound Foundations* group and were statistically significant as calculated by the WWC. In this study, the effect was statistically significant and positive, according to WWC criteria.

Early reading/writing. Byrne and Fielding-Barnsley (1991) analyzed findings for one measure in this outcome domain.[10] The finding favored the *Sound Foundations* group and was statistically significant. The statistical significance of this effect was confirmed by the WWC. In this study, the effect was statistically significant and positive, according to WWC criteria.

Rating of effectiveness

The WWC rates the effects of an intervention in a given outcome domain as: positive, potentially positive, mixed, no discernible effects, potentially negative, or negative. The rating of effectiveness takes into account four factors: the quality of the research design, the statistical significance of the findings,[9] the size of the difference between participants in the intervention condition and the comparison condition, and the consistency in findings across studies (see the WWC Intervention Rating Scheme).

5. Zevenbergen, Whitehurst, and Zevenbergen (2003) report additional results from the sample first reported in Whitehurst et al. (1994), so the WWC reviewed the two manuscripts as a single study.
6. Byrne and Fielding-Barnsley (1991) implemented a modified version of the *Sound Foundations* curriculum, introducing fewer phonemes to children than are specified in the full curriculum (i.e., six phonemes instead of nine).
7. The letter knowledge outcome was not included in this review because it was used to test the prediction that both phoneme identity and letter knowledge are necessary conditions for acquisition of the alphabetic principle. It was not used to test the effects of the intervention.
8. The Extent of Evidence categorization was developed to tell readers how much evidence was used to determine the intervention rating, focusing on the number and size of studies. Additional factors associated with a related concept, external validity, such as students' demographics and the types of settings in which studies took place, are not taken into account for the categorization.
9. The level of statistical significance was reported by the study authors or, where necessary, calculated by the WWC to correct for clustering within classrooms or schools and for multiple comparisons. For an explanation about the clustering correction, see the WWC Tutorial on Mismatch. See Technical Details of WWC-Conducted Computations for the formulas the WWC used to calculate the statistical significance. In the case of the *Sound Foundations* report, corrections for clustering and multiple comparisons were needed.
10. The authors also reported results from the one-, two-, three-, and six-year follow-up tests. Because the primary focus of this review is on the immediate posttest results, the follow-up results are not discussed here but are included in Appendices A5.1–A5.5.

The WWC found *Sound Foundations* to have potentially positive effects for phonological processing and early reading/writing

Improvement index

The WWC computes an improvement index for each individual finding. In addition, within each outcome domain, the WWC computes an average improvement index for each study and an average improvement index across studies (see Technical Details of WWC-Conducted Computations). The improvement index represents the difference between the percentile rank of the average student in the intervention condition versus the percentile rank of the average student in the comparison condition. Unlike the rating of effectiveness, the improvement index is entirely based on the size of the effect, regardless of the statistical significance of the effect, the study design, or the analysis. The improvement index can take on values between –50 and +50, with positive numbers denoting favorable results. A student-level average improvement index and range of improvement indices could not be computed.

Findings for *Sound Foundations plus Dialogic Reading*

The study described below does not contribute to the overall rating of effectiveness because the intervention included a combination of *Sound Foundations* and *Dialogic Reading,* which does not allow the effects of *Sound Foundations* alone to be determined. However, the WWC believes that the findings from this combined intervention may provide useful information to practitioners who are making a determination about the merits of combining *Sound Foundations* with a specific interactive shared book reading practice *(Dialogic Reading)*. The WWC reports the individual study findings here and in Appendices A4.1–A4.4.

Whitehurst et al. (1994) included 167 at-risk low-income four-year-old children from four Head Start centers in Suffolk County, New York. The study compared oral language, print knowledge, phonological processing, and early reading/writing outcomes for children participating in an adapted *Sound Foundations* curriculum combined with *Dialogic Reading* to outcomes for children in a no-treatment comparison group participating in their regular Head Start services.[11]

Oral language. Whitehurst et al. (1994) found no statistically significant difference between the intervention group and the comparison group on oral language as measured by the Language factor.[12] Zevenbergen, Whitehurst, and Zevenbergen (2003), a second report on the same study, reported findings on four additional oral language measures from the same study, none of which were statistically significant as calculated by the WWC. The average effect across the five measures was neither statistically significant nor large enough to be considered substantively important, according to WWC criteria. The average improvement index for oral language is +6 percentile points, with a range of –12 to +19 percentile points across findings.

Print knowledge. Whitehurst et al. (1994) reported a statistically significant difference favoring the intervention group on the Print Concepts factor.[12] The statistical significance of this effect was confirmed by the WWC. The improvement index for print knowledge is +24 percentile points for the one print knowledge outcome in this study.

Phonological processing. Whitehurst et al. (1994) reported neither statistically significant nor substantively important effects on the Linguistic Awareness factor.[12] The improvement index for phonological processing is +1 percentile point for the one phonological processing outcome in this study.

Early reading/writing. Whitehurst et al. (1994) reported a statistically significant difference favoring the intervention group on the Writing factor.[12] The statistical significance of this effect was confirmed by the WWC. The improvement index for early reading/writing is +20 percentile points for the one early reading/writing outcome in this study.

11. Whitehurst et al. (1994) implemented a modified version of the *Sound Foundations* curriculum. Changes included substituting the card games with other games and extension activities and omitting the audio tapes. This study is also included in the WWC *Dialogic Reading* intervention report.
12. To reduce data the study authors conducted a principal components analysis on the 21 measures. The WWC presents results only for the four factor scores (Language factor, Print Concepts factor, Linguistic Awareness factor, and Writing factor) because effect sizes could not be computed for the individual measures.

The WWC found *Sound Foundations* to have potentially positive effects for phonological processing and early reading/writing *(continued)*

Summary

The WWC reviewed four studies on *Sound Foundations.* One of the studies met WWC evidence standards. One additional study that met WWC evidence standards is described in this report but is not included in the overall rating of effectiveness. The remaining two studies did not meet WWC evidence screens. Based on the one study included in the overall rating of effectiveness, the WWC found potentially positive effects for both phonological processing and early reading/writing. Based on the study that included a *Sound Foundations plus Dialogic Reading* intervention, the WWC found no discernible effects on oral language, potentially positive effects on print knowledge, no discernible effects on phonological processing, and potentially positive effects on early reading/writing.

Although this report focuses on immediate posttest findings to determine the effectiveness of the intervention, longer term follow-up findings of the Byrne and Fielding-Barnsley (1991) study (i.e., Byrne & Fielding-Barnsley, 1993, 1995; Byrne, Fielding-Barnsley, & Ashley, 2000) are reported in the technical appendices.

The evidence presented in this report may change as new research emerges.

References

Met WWC evidence standards

Byrne, B., & Fielding-Barnsley, R. (1991). Evaluation of a program to teach phonemic awareness to young children. *Journal of Educational Psychology, 83*(4), 451–455.

Additional sources:

Byrne, B., & Fielding-Barnsley, R. (1993). Evaluation of a program to teach phonemic awareness to young children: A 1-year follow-up. *Journal of Educational Psychology, 85*(1), 104–111.

Byrne, B., & Fielding-Barnsley, R. (1995). Evaluation of a program to teach phonemic awareness to young children: A 2- and 3-year follow-up and a new preschool trial. *Journal of Educational Psychology, 87*(3), 488–503.

Byrne, B., Fielding-Barnsley, R., & Ashley, L. (2000). Effects of preschool phoneme identity training after six years: Outcome level distinguished from rate of response. *Journal of Educational Psychology, 92*(4), 659–667.

Whitehurst, G. J., Epstein, J. N., Angell, A. L., Payne, A. C., Crone, D. A., & Fischel, J. E. (1994). Outcomes of an emergent literacy intervention in Head Start. *Journal of Educational Psychology, 86*(4), 542–555.

Additional sources:

Epstein, J. N. (1994). Accelerating the literacy development of disadvantaged preschool children: An experimental evaluation of a Head Start emergent literacy curriculum. *Dissertation Abstracts International, 55*(11), 5065B. (UMI No. 9510085)

Zevenbergen, A. A., Whitehurst, G. J., & Zevenbergen, J. A. (2003). Effects of a shared-reading intervention on the inclusion of evaluative devices in narratives of children from low-income families. *Journal of Applied Developmental Psychology, 24,* 1–15.

Did not meet WWC evidence screens

Elliott, J., Prior, M., Merrigan, C., & Ballinger, K. (2002). Evaluation of a community intervention programme for preschool behaviour problems. *Journal of Pediatric Child Health, 38,* 41–50.[13]

Whitehurst, G. J., Zevenbergen, A. A., Crone, D. A., Schultz, M. D., Velting, O. N., & Fischel, J. E. (1999). Outcomes of an emergent literacy intervention from Head Start through second grade. *Journal of Educational Psychology, 91*(2), 267–272.[14]

For more information about specific studies and WWC calculations, please see the WWC *Sound Foundations* Technical Appendices.

13. The outcome measures are not relevant to this review.
14. Complete data were not reported: the WWC could not compute effect sizes.